REMARKS

Applicant has reviewed the Office Action of August 21, 2001 requesting election from among the several distinct inventions allegedly claimed.

On a preliminary point, it is noted that a request to extend the one month statutory response deadline to Sunday, October 21, 2001 (which becomes Monday, October 22, 2001) is enclosed. The Examiner is authorized the charge any fees deemed required as a result of this request from Deposit Account 11-0978.

Applicant hereby elects the invention of Group I, which the Examiner contends includes claims 1-49, 50-54, 55-69, 70-82, 85, 94-97, 111-117 and 123-124. It is noted that claim 85 is a dependent claim, and it is believed that the Examiner forgot to list claims 83 and 84 as falling into Group I. Therefore, claims 1-85, 94-97, 111-117, and 123-124 of Group I are elected for examination at the present time. Claims 9, 41, 86-93, 98-110, and 118-122 are cancelled and thereby withdrawn from consideration, without prejudice to presenting them for examination in a continuing application.

The elected claims are also amended as set forth above. Most of the amendments involve replacing "bearing," as defined in the specification, with the broader, ostensibly more generic term "pumping or mixing element."

New dependent claims 125-130 are also presented to emphasize that the bearing described in the preferred embodiment is possibly a subset of the pumping or mixing element. Since each of these claims depends on an independent claim in Group I, examination of them at the present time is proper.

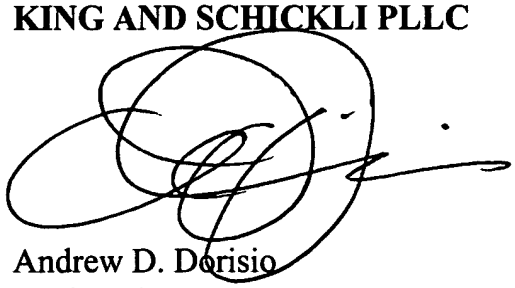
New claims 131-160 are also presented for substantive examination. It is believed that each of these claims is generic or is directed to a species of an invention claimed in Group I and, hence, examination with the Group I claims is proper.

Prior to substantive examination, the specification is also amended as set forth above to make certain adjustments and clarify the wording or terminology used. No new matter is entered. Also, it is noted that: (1) the Title is amended; and (2) the priority claim to the prior U.S. application filed on behalf of the same inventor is deleted. Applicant requests that the Examiner make the appropriate notation on the file jacket to ensure that this priority claim is deleted and that the term of any patent issuing from this application is measured from the earliest extant priority date, or October 9, 2000.

In summary, Applicant elects the invention of Group I for prosecution, and presents certain amendments to the claim and specification prior to substantive examination. Since it is believed that upon examination the Examiner will find that all claims are in condition for allowance over the art of record, early issuance of a notice to this effect is earnestly solicited.

Respectfully submitted,

KING AND SCHICKLI PLLC



Andrew D. Dorisio
Registration No. 41,713

247 North Broadway
Lexington, KY 40503
(859) 252-0889

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231, on October 22, 2001

Date 10/22/01

VERSION OF AMENDED CLAIMS SHOWING CHANGES

In the Title

Please change the title to:

- - PUMPING OR MIXING SYSTEM USING A LEVITATING MAGNETIC [BEARING] ELEMENT, RELATED SYSTEM COMPONENTS, AND RELATED METHODS - -

In the Specification

Please replace the priority claim on page 1 with the following:

- - This application claims the benefit of the filing date of[: (1) U.S. Patent Application Ser. No. 09/460,600, filed December 14, 1999; and (2)] U.S. Provisional Patent Application Ser. No. 60/239,187, filed October 9, 2000. - -

Please replace the second full paragraph on page 7 with the following:

- - In my prior U.S. Patent No. 5,567,672, I describe [a levitating, magnetic "non-contact" bearing] levitating a magnet above a [that is thermally separated from the] superconducting element [by the entirety of the double-walled vacuum jacket of the] in a cryostat, which contains the cooling source used to cool the superconducting element. This [separation reduces the thermal transfer between the cold superconducting element and the levitating bearing as well as the fluid being mixed, so that it] arrangement could possibly be used [in] as part of a system for mixing temperature sensitive fluids, such as cell suspensions or blood, as disclosed herein. However, the resultant increased separation distance [between the superconducting element and the bearing] created by the double wall vacuum gap may

[significantly] decrease[s] the stability and the load capacity of the [bearing] levitating magnet. This may limit the applications in which this arrangement is useful, and could especially preclude use with particularly viscous fluids or with the large volumes of fluid typically present in commercial scale operations. - -

Please replace the second full paragraph on page 9 with the following:

- - To meet these needs, and in accordance with a first aspect of the present invention as described herein, a number of systems that are capable of pumping or mixing fluids, including temperature sensitive fluids, using a magnetic bearing, impeller, rotor or other element or device capable of generating a pumping or mixing action in a fluid (hereinafter generically referred to as a "magnetic bearing') levitated by a superconducting element are disclosed. The magnetic bearing may be placed in a vessel positioned adjacent to the wall of a cryostat or other housing for the superconducting element. A separate cooling source thermally linked to the superconducting element provides the necessary cooling to create the desired superconductive effects and induce levitation in the magnetic bearing. The cryostat outer wall or other housing may define a chamber around the superconducting element. This chamber thermally isolates the superconducting element from the vessel containing the bearing. To minimize thermal transfer from the superconducting element to the outer wall or housing, this chamber is preferably evacuated, but may be instead filled with an insulating material. This thermal isolation and separation means that the superconducting element may be placed in close proximity to the outer wall of the cryostat or other housing adjacent to the vessel to achieve a significant reduction in

the separation distance between the levitating bearing and the superconducting element. This advantageously enhances the magnetic stiffness and loading capacity of the bearing as it levitates. However, since the superconducting element may be thermally isolated from the wall or housing, the magnetic bearing, and hence the vessel and fluid contained therein, are not exposed to the cold temperatures required to generate the desired superconductive effects. By using means external to the vessel to rotate one of the levitating magnetic bearing or the superconducting element, the desired pumping or mixing action is provided. - -.

Please replace the first full paragraph on page 30 with the following:

-- Reference is now made to Figure 1, which shows a first possible embodiment of the mixing or pumping system 10 of the present invention. In this embodiment, a cryostat 12 is used to hold the cooling source for the superconducting element that produces the desired levitation in a pumping or mixing element or device, which as shown in the form of a [the] magnetic bearing 14. The bearing 14 is placed in a vessel 16 positioned external to the cryostat 12, which may already contain a fluid F or may be filled after the bearing is in place. It should be appreciated at the outset that the term "fluid" is used herein to denote any substance that is capable of flowing, as may include fluid suspensions, gases, gaseous suspensions, or the like, without limitation. The vessel 16 for holding the fluid is shown as being cylindrical in shape and may have an open top. Alternatively, it may be completely sealed from the ambient environment to avoid the potential for fluid contamination or leakage during mixing, or adapted to pump the fluid F from an inlet to an outlet in the vessel

16 (see Figure 2). In any case, the vessel 16 may be fabricated of any material suitable for containing fluids, including glass, plastic, metal, or the like. Of course, the use of lightweight plastic or other high density polymers is particularly desirable if the vessel 16 is going to be discarded after mixing or pumping is complete, as set forth in more detail in the description that follows. - -

In the Claims

Please amend claim 1 as follows:

1. (Amended) A system for pumping or mixing a fluid in a vessel, comprising:

a magnetic [bearing] pumping or mixing element for placement in the vessel;

at least one superconducting element for levitating said magnetic [bearing] pumping or mixing element;

a wall defining a chamber around the superconducting element, said chamber thermally isolating the superconducting element from the vessel;

a [separate] cooling source thermally linked to said superconducting element;

a motive device for rotating [said magnetic bearing or] said superconducting element.

Please amend claim 6 as follows:

6. (Amended) The system for pumping or mixing a fluid according to claim 1, wherein said levitating magnetic [bearing] pumping or mixing element further includes a first permanent magnet positioned adjacent to said superconducting element but external to said wall.

Please amend claim 7 as follows:

7. (Amended) The system for pumping or mixing a fluid according to claim 6, wherein said magnetic [bearing] pumping or mixing element further includes a second permanent magnet spaced from said first permanent magnet for forming a magnetic coupling with [a drive magnet forming a part of said motive device] said superconducting element, whereby said magnetic coupling serves to transmit driving torque from said [drive magnet] superconducting element to said magnetic [bearing] pumping or mixing element.

Please amend claim 8 as follows:

8. (Amended) The system for pumping or mixing a fluid according to claim 7, wherein said motive device for said [magnetic bearing] superconducting element includes a motor [for rotating said drive magnet].

Please amend claim 10 as follows:

10. (Amended) The system for pumping or mixing a fluid according to claim 1, wherein said wall is below said magnetic [bearing] pumping or mixing element and the vessel rests atop said wall.

Please amend claim 12 as follows:

12. (Amended) The system for pumping or mixing a fluid according to claim 1, wherein the vessel includes an inlet and an outlet and said rotating magnetic [bearing] pumping or mixing element includes at least one blade for creating a pumping action that forces fluid to move from said inlet to said outlet.

Please amend claim 13 as follows:

13. (Amended) The system for pumping or mixing a fluid according to claim 1, wherein said vessel is completely sealed and said magnetic [bearing] pumping or mixing element serves to mix the fluid only.

Please amend claim 14 as follows:

14. (Amended) The system for pumping or mixing a fluid according to claim 1, wherein the vertical center axis of rotation of the magnetic [bearing] pumping or mixing element is offset from the vertical center axis of the vessel.

Please amend claim 21 as follows:

21. (Amended) The system for pumping or mixing a fluid according to claim 16, wherein said chamber housing said superconducting element is positioned below said magnetic [bearing] pumping or mixing element in said vessel.

Please amend claim 22 as follows:

22. (Amended) The system for pumping or mixing a fluid according to claim 16, wherein the vessel is supported by a stable support structure positioned between said superconducting element and said magnetic [bearing] pumping or mixing element.

Please amend claim 23 as follows:

23. (Amended) The system for pumping or mixing a fluid according to claim 16, wherein the magnetic [bearing] pumping or mixing element includes first and second magnets having different polarities to create a non-symmetrical magnetic field with respect to an axis of rotation of said superconducting element.

Please amend claim 24 as follows:

24. (Amended) The system for pumping or mixing a fluid according to claim 16, wherein the magnetic [bearing] pumping or mixing element includes at least one low-profile rod carrying first and second magnets, wherein said rod is capable of being inserted in a relatively narrow opening in the vessel.

Please amend claim 25 as follows:

25. (Amended) The system for pumping or mixing a fluid according to claim 16, wherein the magnetic [bearing] pumping or mixing element includes a pair of interconnected rods that are substantially orthogonal to each other in a nominal position with each rod carrying first and second magnets having the same polarities.

Please cancel claims 29-38 without prejudice.

Please amend claim 39 as follows:

39. (Amended) The system for pumping or mixing a fluid according to claim 1, further including a transmitter for transmitting a signal or receiver for receiving the signal, and wherein either said magnetic [bearing] pumping or mixing element or the vessel includes one of the transmitter or the receiver and the other is positioned adjacent to said superconducting element, wherein the operation of said motive device is restricted until the signal generated by the transmitter is received by said receiver.

Please amend claim 42 as follows:

42. (Amended) The system for pumping or mixing a fluid according to claim 1, wherein the vessel is a pipe, the superconducting element includes at least two superconducting members each thermally separated or isolated from the outer surface of the

pipe, and said [bearing] pumping or mixing element includes at least two levitation magnets, each corresponding to one of said at least two superconducting members, whereby said magnetic [bearing] pumping or mixing element is levitated in said pipe as a result of the interaction between [each] said superconducting members and the corresponding levitation magnets.

Please amend claim 43 as follows:

43. (Amended) The system for pumping or mixing a fluid according to claim 42, wherein said magnetic [bearing] pumping or mixing element further includes a plurality of alternating polarity driven magnets.

Please amend claim 44 as follows:

44. (Amended) The system for pumping or mixing a fluid according to claim 43, wherein the motive device includes a bearing positioned outside of said pipe for rotatably supporting a driving magnet assembly carrying a plurality of alternating polarity driving magnets, a motor, and an endless belt for transmitting rotary motion from said motor to said driving magnet assembly, wherein the driving magnet assembly upon rotating creates a varying magnetic field that influences said driven magnets and causes said magnetic [bearing] pumping or mixing element to rotate.

Please amend claim 45 as follows:

45. (Amended) The system for pumping or mixing a fluid according to claim 43, wherein the motive device includes a winding positioned external to said pipe and a power supply for supplying an electrical current to said winding, wherein said winding creates an

electrical field that causes said levitating magnetic [bearing] pumping or mixing element to rotate in said pipe.

Please amend claim 46 as follows:

46. (Amended) The system for pumping or mixing a fluid according to claim 1, wherein said [bearing] pumping or mixing element includes at least one levitation-assist chamber for holding a substance that is lighter than the fluid in said vessel, whereby the chamber assists in levitating the magnetic [bearing] pumping or mixing element in the fluid.

Please amend claim 47 as follows:

47. (Amended) The system for pumping or mixing a fluid according to claim 1, wherein the motive device is a first motive device, and further including a second motive device for moving the superconducting element relative to the vessel, whereby effective, non-localized pumping or mixing action may be provided [by the magnetic bearing as a result].

Please amend claim 50 as follows:

50. (Amended) A system for mixing a fluid, comprising:

a vessel for holding the fluid;

a magnetic [bearing] pumping or mixing element for positioning in said vessel;

a superconducting element for levitating and forming a magnetic coupling with said magnetic pumping or mixing element;

a housing defining a chamber around said superconducting element for thermally isolating said superconducting element from said vessel;

a cooling source thermally linked to said superconducting element; and

a motive device for rotating said [magnetic bearing or said] superconducting element.

Please amend claim 52 as follows:

52. (Amended) The mixing system according to claim 50, wherein said vessel includes an inlet and an outlet and said magnetic [bearing] pumping or mixing element further includes at least one blade or vane for creating a pumping action that forces fluid to move from said inlet to said outlet.

Please amend claim 53 as follows:

54. (Amended) The mixing system according to claim 50, wherein said vessel and magnetic [bearing] pumping or mixing element are disposable.

Please amend claim 55 as follows:

55. (Amended) A system for pumping or mixing a fluid in a vessel positioned on a stable support structure, comprising:

a magnetic [bearing] pumping or mixing element for placement in the vessel;

at least one superconducting element for levitating said magnetic [bearing] pumping or mixing element;

a cooling source thermally linked to said superconducting element in said chamber;

a motive device for rotating said superconducting element.

Please amend claim 59 as follows:

59. (Amended) The system for pumping or mixing a fluid according to claim 56, wherein said chamber housing said superconducting element is positioned below said magnetic [bearing] pumping or mixing element in said vessel.

Please amend claim 60 as follows:

60. (Amended) The system for pumping or mixing a fluid according to claim 55, wherein said magnetic [bearing] pumping or mixing element includes at least one blade or vane, whereby said blade or vane provides the desired pumping or mixing action when the [bearing] pumping or mixing element is rotated.

Please amend claim 61 as follows:

61. (Amended) The system for pumping or mixing a fluid according to claim 55, wherein said vessel is a centrifugal pumping head having an inlet and an outlet, wherein the rotation of said magnetic [bearing] pumping or mixing element causes the fluid to move from the inlet to the outlet.

Please amend claim 63 as follows:

63. (Amended) The system for pumping or mixing a fluid according to claim 55, wherein the vessel is supported by a stable support structure positioned between said superconducting element and said magnetic [bearing] pumping or mixing element.

Please amend claim 64 as follows:

64. (Amended) The system for pumping or mixing a fluid according to claim 55, wherein the magnetic [bearing] pumping or mixing element includes first and second

magnets having different polarities to create a non-symmetrical magnetic field with respect to an axis of rotation of said superconducting element.

Please amend claim 66 as follows:

66. (Amended) The system for pumping or mixing a fluid according to claim 55, wherein the magnetic [bearing] pumping or mixing element includes at least one low-profile rod carrying first and second magnets having the different polarities, said rod being capable of insertion in a relatively narrow opening in the vessel.

Please amend claim 67 as follows:

67. (Amended) The system for pumping or mixing a fluid according to claim 55, wherein the magnetic [bearing] pumping or mixing element includes a pair of interconnected rods that are substantially orthogonal to each other in a nominal position, each carrying first and second magnets having the same polarity.

Please amend claim 70 as follows:

70. (Amended) A system for pumping or mixing a fluid in a vessel, comprising:

a magnetic [bearing] pumping or mixing element for placement in the vessel;

a superconducting element for levitating said magnetic [bearing] pumping or mixing element;

a wall defining a chamber around the superconducting element, said chamber thermally isolating the superconducting element from the vessel;

a [separate] cooling source thermally linked to said superconducting element;

a motive device for rotating said magnetic [bearing] pumping or mixing

element, wherein at least a portion of said motive device is positioned adjacent to and concentric with the superconducting element.

Please amend claim 73 as follows:

73. (Amended) The system for pumping or mixing a fluid according to claim 72, further including a platform in said chamber for supporting the superconducting element, wherein the platform is thermally linked to the [separate] cooling source.

Please amend claim 77 as follows:

77. (Amended) The system for pumping or mixing a fluid according to claim 70, wherein said motive device includes a shaft carrying a plurality of alternating polarity driving magnets corresponding to a plurality of driven magnets on said magnetic [bearing] pumping or mixing element, said driving magnets being received in a thermally separated or isolated bore formed by the wall defining the chamber around said superconducting element.

Please amend claim 78 as follows:

78. (Amended) The system for pumping or mixing a fluid according to claim 77, wherein said magnetic [bearing] pumping or mixing element comprises:

a levitation magnet corresponding in size and shape to the superconducting element;

at least two driven magnets having opposite polarities, said driven magnets being aligned with the corresponding driving magnets of said motive device,

whereby said levitation magnet levitates said [bearing] pumping or mixing

element while said driven magnets transmit rotary motion to said [bearing] pumping or mixing element from said driving magnets.

Please amend claim 80 as follows:

80. (Amended) The system for pumping or mixing a fluid according to claim 70, wherein said magnetic [bearing] pumping or mixing element carries at least one blade or vane.

Please amend claim 82 as follows:

82. (Amended) The system for pumping or mixing a fluid according to claim 70, wherein the vessel is a pipe, the wall defining the chamber thermally isolating the superconducting element is positioned inside of said pipe and includes a thermally separated or isolated bore for receiving a driven shaft carrying a plurality of alternating polarity driving magnets forming a part of said motive device and magnetically coupling with a plurality of corresponding driven magnets in or on said magnetic [bearing] pumping or mixing element.

Please amend claim 83 as follows:

83. (Amended) A system for pumping or mixing a fluid in a vessel, comprising:

a magnetic [bearing] pumping or mixing element for placement in the vessel;

at least one superconducting element for levitating said magnetic [bearing] pumping or mixing element;

a wall defining a chamber around the superconducting element, said chamber thermally isolating the superconducting element from the vessel;

a [separate] cooling source thermally linked to said superconducting element;

a first motive device for rotating said magnetic [bearing] pumping or mixing element or said superconducting element;

a second motive device for moving the superconducting element relative to the vessel,

whereby moving the superconducting element ensures that effective, non-localized pumping or mixing action is afforded by the levitating, rotating [bearing] pumping or mixing element.

Please amend claim 94 as follows:

94. (Amended) A system for pumping or mixing a fluid in a vessel, comprising:

a magnetic [bearing] pumping or mixing element for placement in the vessel;

at least one superconducting element for levitating said magnetic [bearing] pumping or mixing element;

a [separate] cooling source thermally linked to said superconducting element;

a motive device for rotating one of said magnetic [bearing] pumping or mixing element or said superconducting element,

wherein said [bearing] pumping or mixing element includes at least one levitation-assist chamber for holding a substance that is lighter than the fluid in said vessel, whereby the chamber assists in levitating the magnetic [bearing] pumping or mixing element in the fluid.

Please amend claim 96 as follows:

96. (Amended) The system for pumping or mixing a fluid according to claim 94,

wherein said levitating magnetic [bearing] pumping or mixing element further includes a first permanent magnet positioned adjacent to said superconducting element and a second permanent magnet spaced from said first permanent magnet for forming a magnetic coupling with a drive magnet forming a part of said motive device [, wherein a levitation-assist chamber is provided on each of said magnetic bearings].

Please amend claim 111 as follows:

111. (Amended) A method of levitating and rotating a magnetic [bearing] pumping or mixing element for pumping or mixing a fluid, comprising:

placing the magnetic [bearing] pumping or mixing element in the vessel;

levitating the magnetic [bearing] pumping or mixing element above a superconducting element positioned in an evacuated or insulated chamber adjacent to the vessel and thermally linked to a [separate] cooling source; and

rotating the superconducting element to induce rotation in the magnetic [bearing] pumping or mixing element in the vessel.

Please amend claim 112 as follows:

112. (Amended) The method according to claim 111, further including the steps of placing said magnetic [bearing] pumping or mixing element in the vessel prior to filling the vessel with a fluid, and after mixing or pumping is completed, disposing of said magnetic [bearing] pumping or mixing element and vessel.

Please amend claim 113 as follows:

113. (Amended) The method according to claim 112, including the step of completely

sealing the vessel prior to rotating said magnetic [bearing] pumping or mixing element.

Please amend claim 114 as follows:

114. (Amended) The method according to claim 111, wherein the magnetic [bearing] pumping or mixing element includes at least two magnets having different polarities to create a non-symmetrical magnetic field relative to an axis of rotation of said superconducting element [, and said step of rotating the magnetic bearing includes rotating the superconducting element to cause said magnetic bearing to rotate about said axis].

Please amend claim 21 as follows:

115. (Amended) The method according to claim 111, wherein the vessel is a flexible bag for containing the fluid, and the method further includes placing the [bearing] pumping or mixing element in the flexible bag prior to filling the bag with the fluid.

Please amend claim 116 as follows:

116. (Amended) A method of levitating and rotating a magnetic [bearing] pumping or mixing element for pumping or mixing a fluid, comprising:

placing a magnetic [bearing] pumping or mixing element carrying first and second magnets having different polarities to create a non-symmetrical magnetic field in a vessel;

levitating the magnetic [bearing] pumping or mixing element in the vessel using a superconducting element;

rotating the superconducting element to induce rotation in the [bearing] pumping or mixing element.

Please amend claim 117 as follows:

117. (Amended) A method of levitating and rotating a magnetic [bearing] pumping or mixing element for pumping or mixing a fluid, comprising:

placing a magnetic [bearing] pumping or mixing element in the vessel;

levitating the magnetic [bearing] pumping or mixing element in the vessel using a superconducting element;

rotating the magnetic [bearing] pumping or mixing element using a driving magnet positioned adjacent to and concentric with the superconducting element.

Please amend claim 123 as follows:

123. (Amended) A method of levitating and rotating a magnetic [bearing] pumping or mixing element for pumping or mixing a fluid in a vessel, comprising:

placing the magnetic [bearing] pumping or mixing element in the vessel;

levitating the magnetic [bearing] pumping or mixing element above a superconducting element positioned in an evacuated or insulated chamber adjacent to the vessel and thermally linked to a [separate] cooling source;

rotating the magnetic [bearing] pumping or mixing element in the vessel;

moving the superconducting element relative to the vessel,

whereby the rotating magnetic [bearing] pumping or mixing element follows the movement of the superconducting element to ensure that effective, non-localized pumping or mixing action is provided.

Please amend claim 124 as follows:

124. (Amended) The method according to claim 123, wherein the step of rotating the magnetic [bearing] pumping or mixing element includes rotating the superconducting element, and wherein the step of moving the superconducting element includes moving the superconducting element to and fro relative to the vessel in a linear fashion.